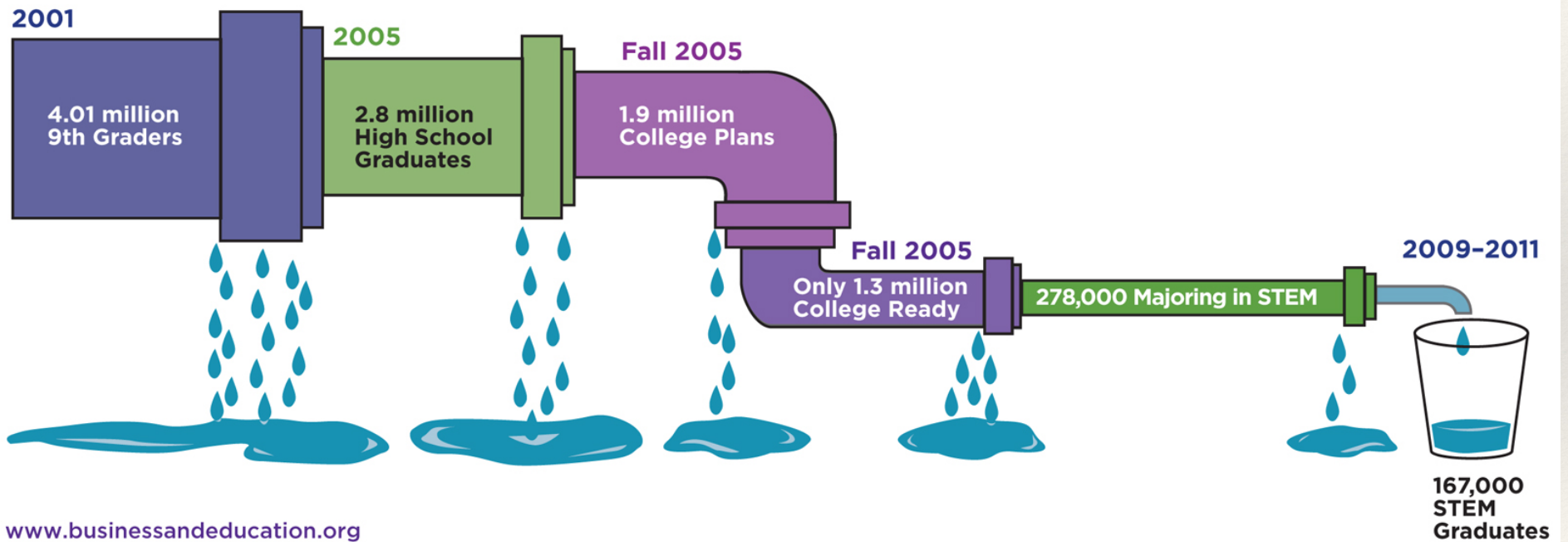

Women in Computer Science

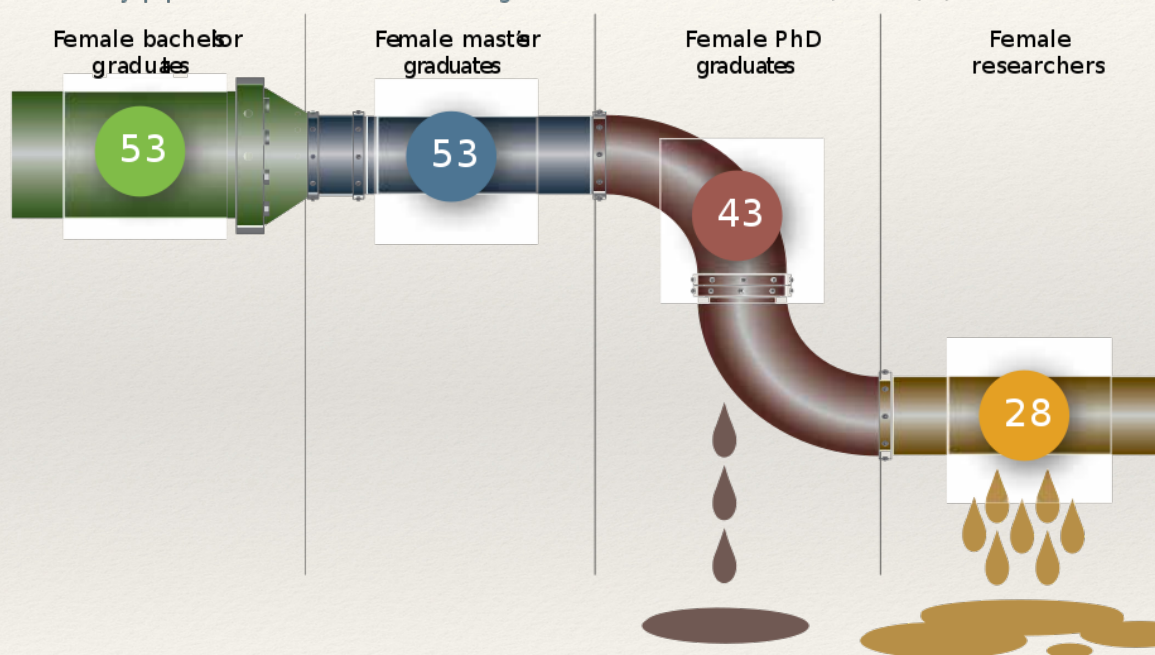
A leaking pipeline

A Leaking STEM Pipeline



A leaking pipeline

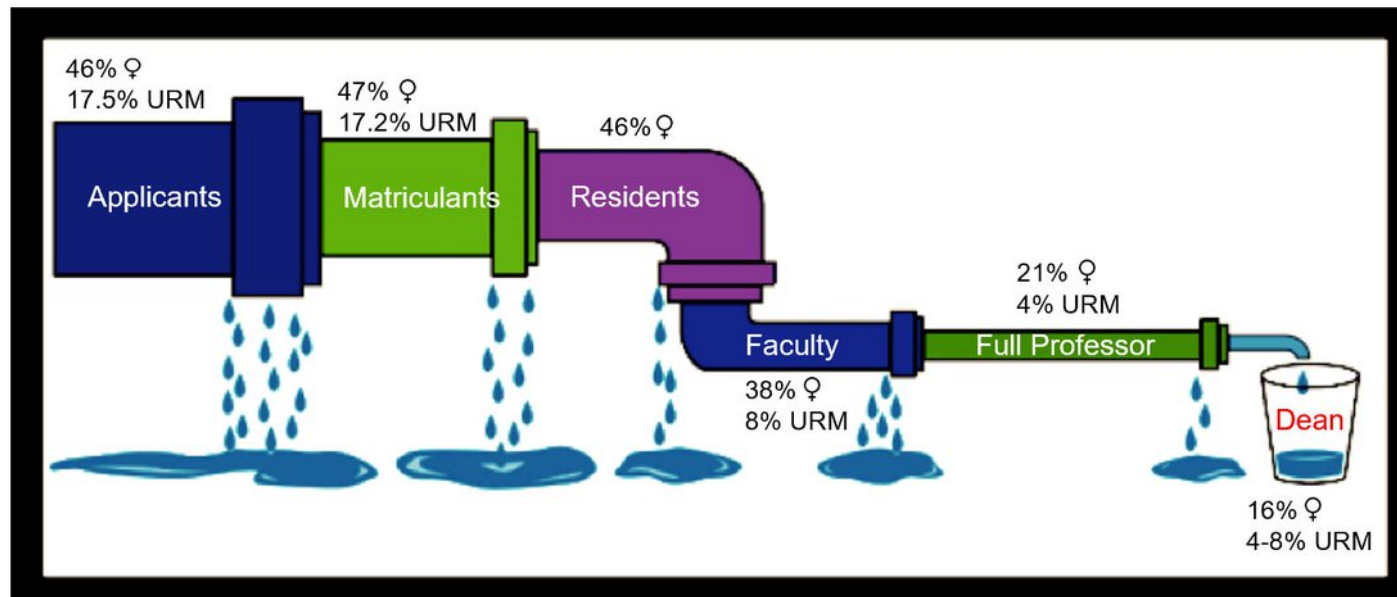
The leaky pipeline: share of women in higher education and research, 2013 (%)



Source: UNESCO Institute for Statistics estimates based on data from its database, July 2015

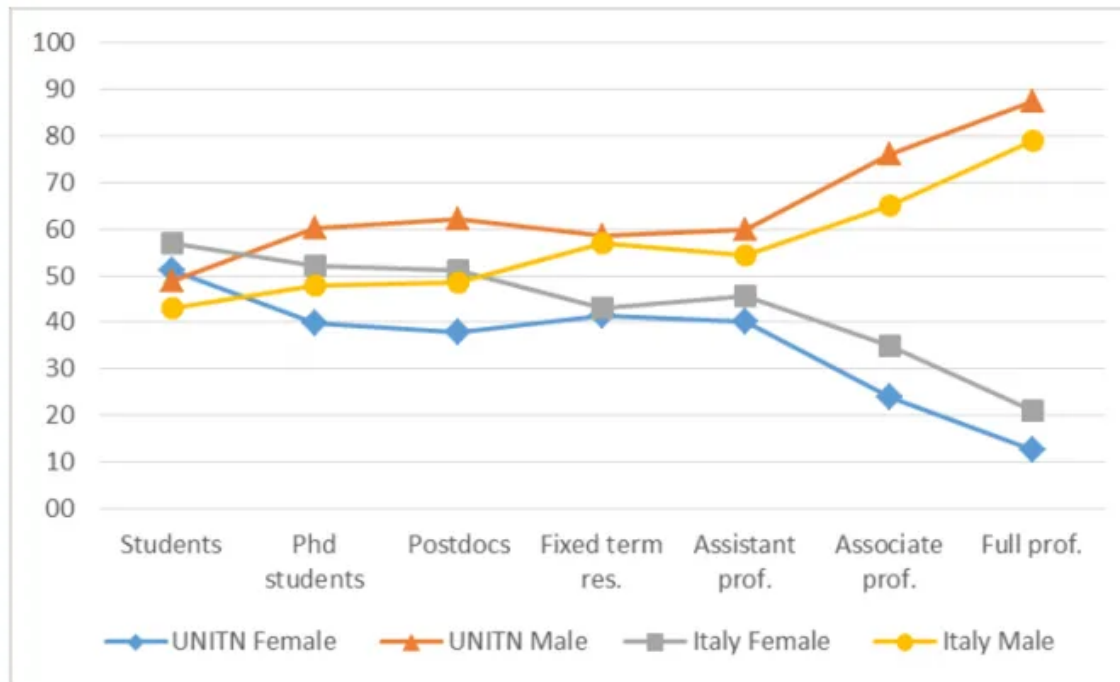
A leaking pipeline

Leaky Pipeline to Academic Leadership



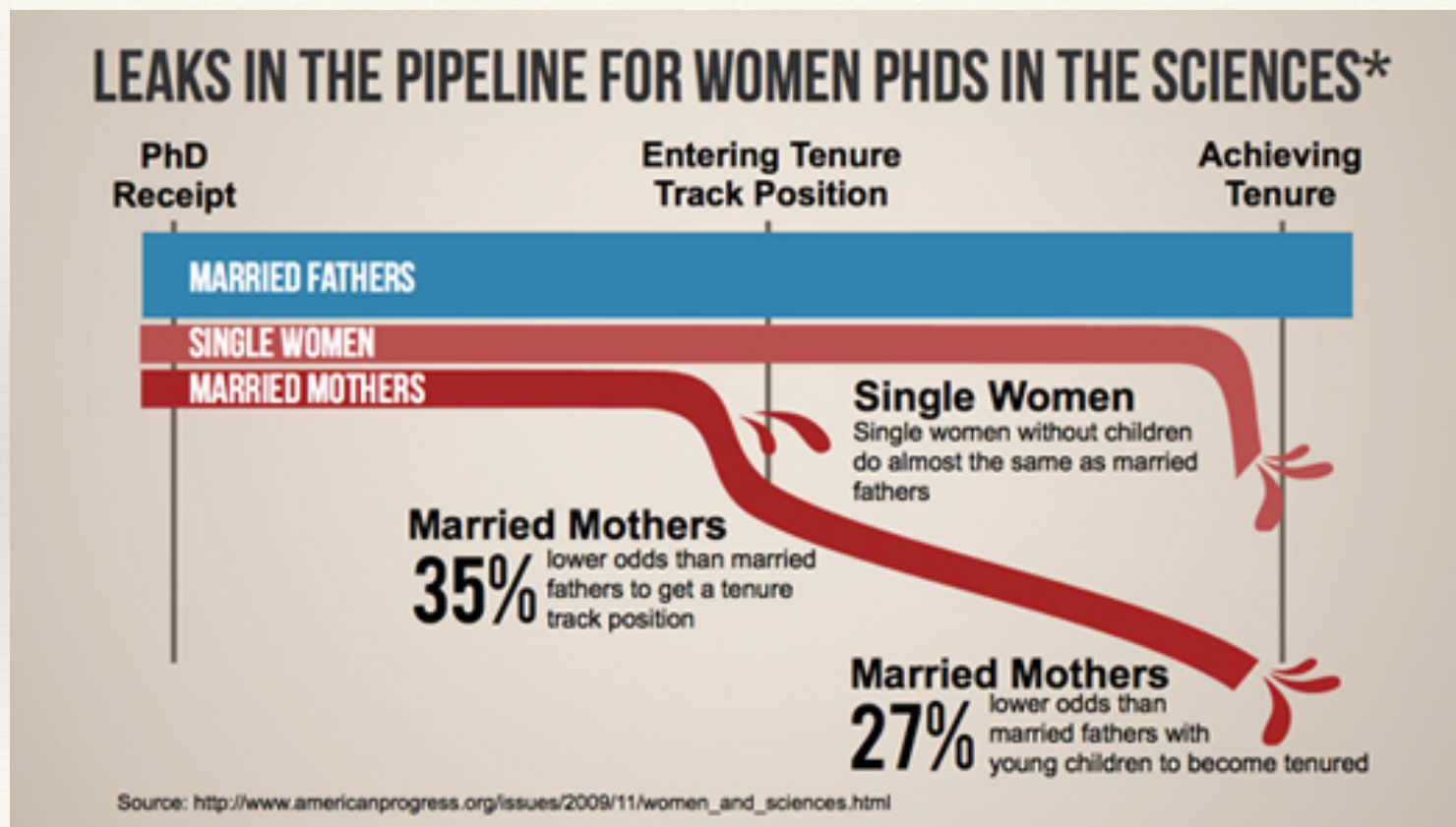
A leaking pipeline

Figure 2 – Scissor diagram, University of Trento and Italy 2013



Source: For Italy: Miur data; for UNITN: Ufficio Studi.

A leaking pipeline



A leaking pipeline

Leaky pipeline

In 2015, women earned

48% of medical school degrees

55% of life sciences doctorates

38% of medicinal chemistry doctorates

In biotech, women represent

50% of entry-level positions

20% of leadership positions

10% of board seats

Sources: Association of American Medical Colleges, National Science Foundation, Liftstream, MassBio

Women's and men's career paths diverge dramatically after the manager level.

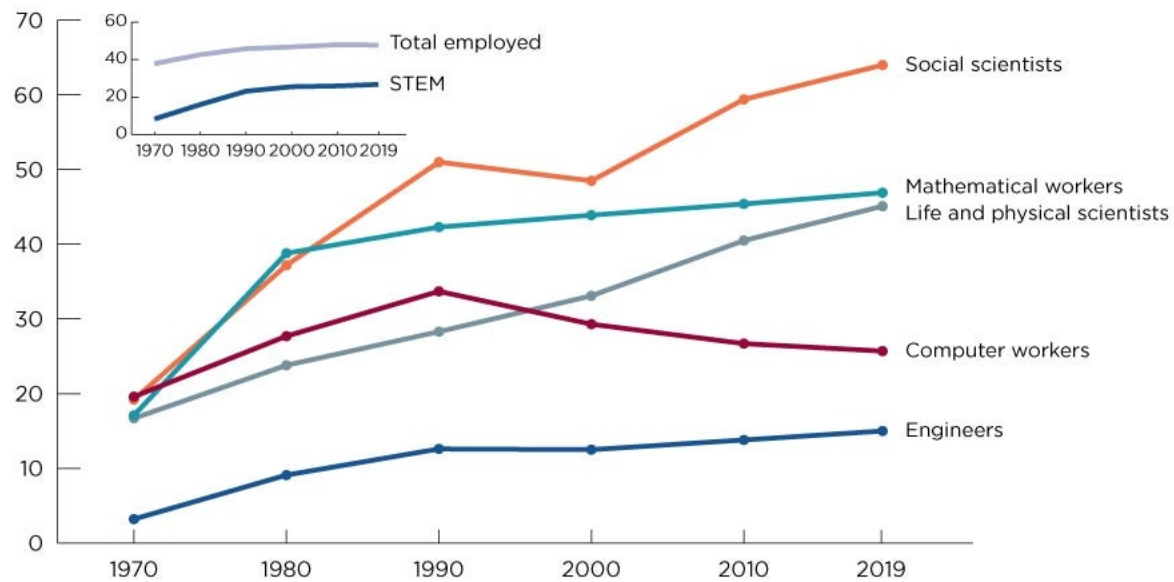


Source: Liftstream and MassBio survey of more than 900 life sciences workers in Massachusetts

A leaking pipeline

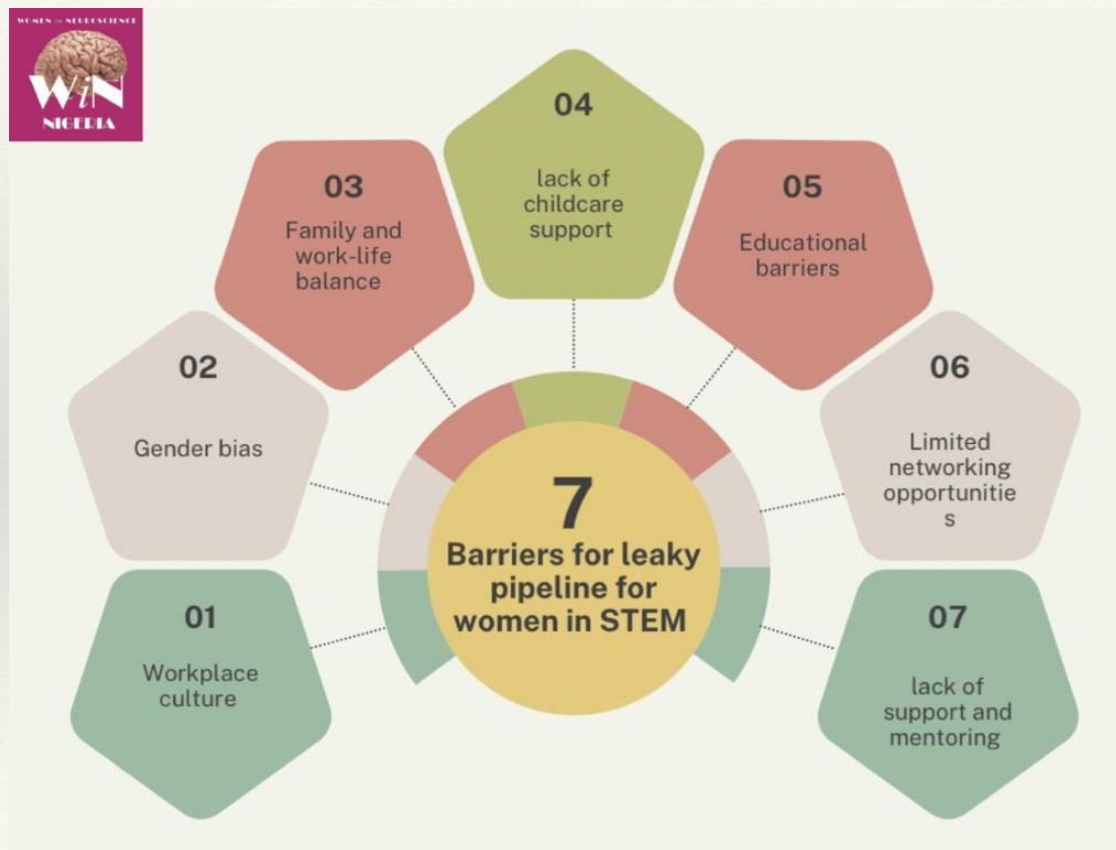
Percentage of Women in STEM Jobs: 1970-2019

(Civilian employed, 16 years and over)



Source: U.S. Census Bureau, 1970, 1980, 1990 and 2000 Censuses; 2010 and 2019 American Community Surveys, 1-Year Estimates.

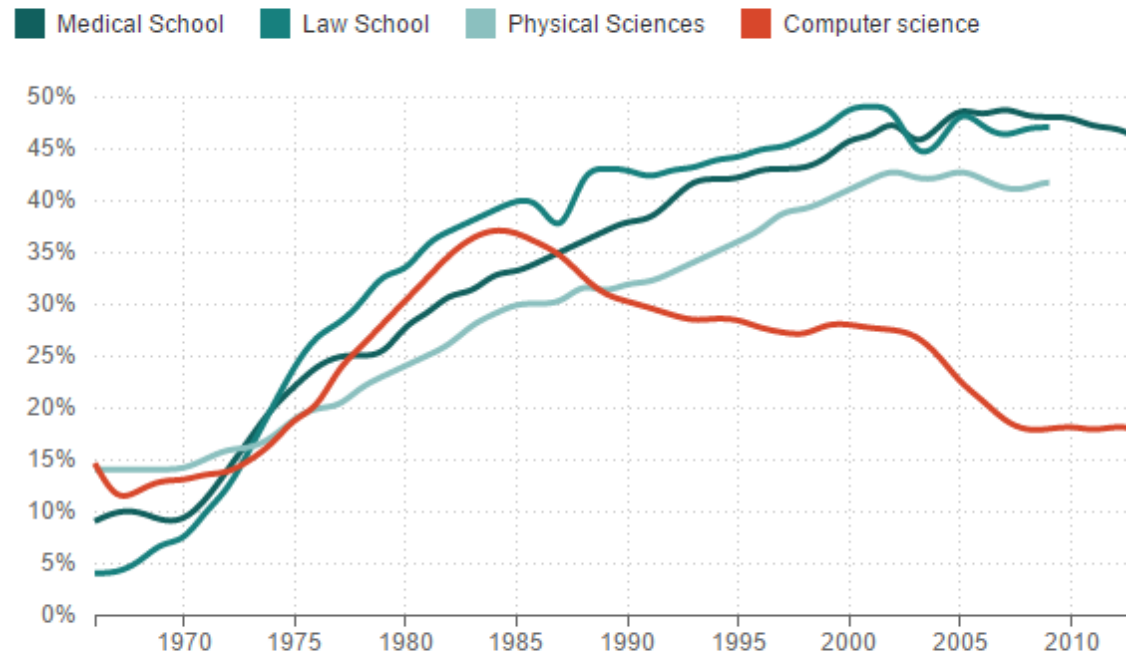
What is wrong?



What is wrong?

What Happened To Women In Computer Science?

% Of Women Majors, By Field



Source: National Science Foundation, American Bar Association, American Association of Medical Colleges
Credit: Quoc Trung Bui/NPR

Early computing



The Computer Girls BY LOIS MANDEL

A trainee gets \$8,000 a year ... a girl "senior systems analyst" gets \$20,000—and up! Maybe it's time to investigate....

Ann Richardson, IBM systems engineer, designs a bridge via computer. Above (left) she checks her facts with fellow systems engineer, Marvin V. Fuchs. Right, she feeds facts into the computer. Below, Ann demonstrates on a viewing screen how her facts designed the bridge, and makes changes with a "light pen."

Twenty years ago, a girl could be a secretary, a school teacher . . . maybe a librarian, a social worker or a nurse. If she was really ambitious, she could go into the professions and compete with men . . . usually working harder and longer to earn less pay for the same job.

Now have come the big, dazzling computers—and a whole new kind of work for women: programming. Telling the miracle machines what to do and how to do it. Anything from predicting the weather to sending out billing notices from the local department store.

And if it doesn't sound like woman's work—well, it just is.

("I had this idea I'd be standing at a big machine and pressing buttons all day long," says a girl who programs for a Los Angeles bank. I couldn't have been further off the track. I figure out how the

computer can solve a problem, instruct the machine to do it.

"It's just like planning a party," explains Dr. Grace Hopper, a scientist in systems programming at the University of Pennsylvania. (She helped develop the first electronic digital computer, the ENIAC, in 1946.) "You have to plan everything so it's ready when you need it. Programming requires a keen, logical mind and the ability to handle details. These are 'naturals' at computer programming."

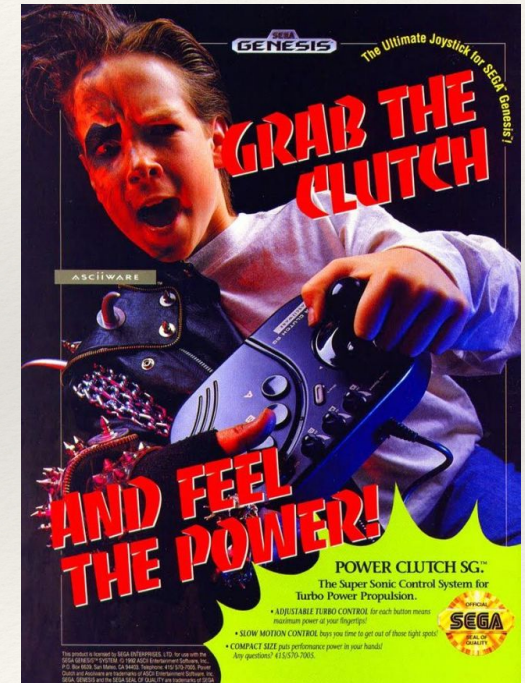
What she's talking about is the one most important quality a woman needs to become a programmer: a keen, logical mind. It zeroes out the old Billie Holiday image of femininity, for a time, because this is the age of the computer. There are twenty-two of them in the United States (cont.)

From the 1940s till late 1970s, programming was considered akin to secretarial duties

Cosmopolitan, 1967: The Computer Girls

Personal Computing Revolution

- ❖ Home computers were marketed primarily to boys and men
- ❖ Early ads and marketing portrayed computers as toys for males
- ❖ Gaming industry targeted male audiences
- ❖ Created an early experience gap between boys and girls



Cultural changes

- ❖ Media began portraying programmers as male "geeks" or "hackers"
- ❖ The stereotype of the antisocial male programmer became dominant
- ❖ "Computer nerd" culture became associated with masculinity
- ❖ Movies and TV reinforced these stereotypes



Shift in workplace culture

- ❖ "Bro culture" in tech companies
- ❖ Unconscious bias in hiring and promotion
- ❖ Lack of female mentors and role models
- ❖ Work-life balance challenges
- ❖ Harassment and discrimination issues
- ❖ Systemic Reinforcement



James Damore (former Google employee)

- Differences in distributions of traits between men and women may in part explain why we don't have 50% representation of women in tech and leadership.
- Discrimination to reach equal representation is unfair, divisive, and bad for business.

James Damore (former Google employee)

Left Biases	Right Biases
Compassion for the weak	Respect for the strong/authority
Disparities are due to injustices	Disparities are natural and just
Humans are inherently cooperative	Humans are inherently competitive
Change is good (unstable)	Change is dangerous (stable)
Open	Closed
Idealist	Pragmatic

James Damore (former Google employee)

Personality differences

Women, on average, have more:

- Openness directed towards feelings and aesthetics rather than ideas. Women generally also have a stronger interest in **people rather than things**, relative to men (also interpreted as **empathizing vs. systemizing**).
 - These two differences in part explain why women relatively prefer jobs in social or artistic areas. More men may like coding because it requires systemizing and even within SWEs, comparatively more women work on front end, which deals with both people and aesthetics.
- Extraversion expressed as gregariousness rather than assertiveness. Also, higher agreeableness.
 - This leads to women generally having a harder time negotiating salary, asking for raises, speaking up, and leading. Note that these are just average differences and there's overlap between men and women, but this is seen solely as a women's issue. This leads to exclusory programs like Stretch and swaths of men without support.
- **Neuroticism** (higher anxiety, lower stress tolerance).
 - This may contribute to the higher levels of anxiety women report on Googlegeist and to the lower number of women in high stress jobs.

James Damore (former Google employee)

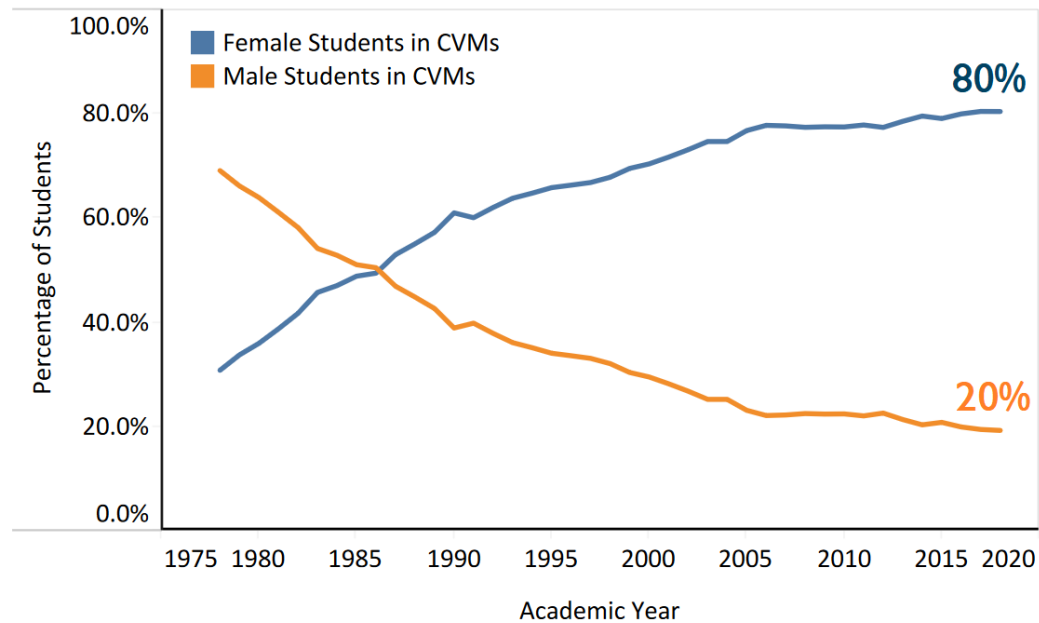
My concrete suggestions are to:

- De-moralize diversity.
 - As soon as we start to **moralize an issue**, we stop thinking about it in terms of costs and benefits, dismiss anyone that disagrees as immoral, and harshly punish those we see as villains to protect the “victims.”

Gender biases



Gender Representation at US Colleges of Veterinary Medicine Internal AAVMC Data Reports 1978-2018



Salaries (Bureau of Labor Statistics)

Pediatric Surgeons	\$449,320
Cardiologists	423,250
Orthopedic Surgeons, Except Pediatric	378,250
Radiologists	353,960
Surgeons, All Other	343,990
Dermatologists	342,860
Anesthesiologists	339,470
Ophthalmologists, Except Pediatric	312,120
Emergency Medicine Physicians	306,640
Obstetricians and Gynecologists	278,660
Neurologists	271,470
Physicians, pathologists	270,560
Psychiatrists	256,930
Physicians, all other	248,640
General internal medicine physicians	245,450
Family medicine physicians	240,790
Pediatricians, general	205,860

Veterinary services	\$119,720
Social advocacy organizations	110,590
Educational services; state, local, and private	108,950
Government	104,420